REMARKS

Claims 1-18 are pending in the present application, with claims 9-17 being withdrawn. Claims 1-4 have been amended. New claim 18 has been added. No new matter has been added by way of the above amendments.

Restriction requirement

Applicants acknowledge the rejoinder of Groups I-III and thus the examination of claims 1-8. Claims 9-17 remain withdrawn.

Priority claim

The Examiner notes that English translations of the Japanese and PCT priority applications have not been submitted. Applicants note for the record that an English translation of the priority documents only needs to be provided if the document(s) is being relied upon to antedate a reference.

The Examiner further notes that because he cannot locate the elected sequence information (SEQ ID NOS: 3 and 4) in PCT/JP04/16297, thus he considers the filing date of the application to be the US filing date of April 15, 2006. Applicants respectfully note that Sequence Listings are not included with the publication of PCT applications and are maintained separately on the WIPO website as part of the electronic documents. Thus, the Examiner is directed to the WIPO website for the Sequence Listing that was filed as part of the PCT application. SEQ ID NOS:3 and 4 are contained in the PCT sequence listing on the WIPO site. Thus, SEQ ID NOS: 3 and 4 are part of the original PCT filing and the US filing date of instant application is the International filing date of November 4, 2004. Acknowledgement of the filing date is respectfully requested.

Objections to the claims

Claims 3-4 and 8 have been objected to for the reasons noted on pages 3 and 4 of the Office Action. Claims 3-4 and 8 have been amended pursuant to the suggestions of the Examiner. Withdrawal of the objections is therefore respectfully requested.

Rejections under 35 U.S.C.§101

Claims 1 and 2 have been rejected under 35 U.S.C.§101 as being drawn to non-statutory subject matter. Claims 1 and 2 have been amended, as suggested by the Examiner, to recite, "An isolated peptide" and "An isolated gene", respectively. Withdrawal of the rejection is therefore respectfully requested.

Rejections under 35 U.S.C.§112, 2nd paragraph

Claims 1-8 have been rejected under 35 U.S.C.§112, 2nd paragraph as being indefinite. Regarding claims 1 and 2, the Examiner asserts that recitation in (d) of "a bacterium-derived peptide" is unclear. This feature has been deleted from claims 1 and 2 as it being superfluous.

Part (d) of claims 1 and 2 has further been rejected for recitation of "a DNA hybridizable to a complementary DNA to said DNA under stringent conditions." On page 6 of the Office Action, the Examiner notes that the basis for this rejection is the lack of defined hybridization conditions in the claims. Claims 1 and 2 have been amended to incorporate the hybridization conditions recited on page 15 of the specification.

As the above amendments address and overcome the rejections under 35 U.S.C.§112, 2nd paragraph, withdrawal thereof is respectfully requested.

Rejections under 35 U.S.C.§112, 1st paragraph

Claims 1-8 have been rejected under 35 U.S.C.§112, 1st paragraph as lacking enablement and sufficient written description. The Examiner asserts that the claims lack enablement and that the inventors were not in possession of (lack of written description) for the following recited embodiments of the claims:

1) Peptides of SEQ ID NO: 4 having additions, substitutions or deletions (claims 1 and 2) – Claims 1 and 2 have been amended to delete embodiment (b), which recited a sequence having an "addition, deletion or substitution at one or a plurality of amino acids..." Thus, withdrawal of the rejections as to these embodiments of the claims is rendered moot.

2) Peptides having 50% or more identity to SEQ ID NO:4 (claims 1 and 2) – Applicants traverse these rejections as they pertains to original embodiment (c)(amended embodiment (b)) of the claims.

The specification beginning at page 14 states,

> The peptide of (c) is a peptide which consists of an amino acid sequence having a 50% or more identity (ratio of identical amino acid sequence) with the peptide of (a) when the entire regions of both peptides are compared, and has β-ionone ring-2-hydroxylase activity. The "50% or more identity" is based on the following reason. Briefly, as described earlier in "Background Art", since the gene encoding an *Erwinia uredovora*-derived β-ionone ring-3-hydroxylase (CrtZ) was elucidated for the first time 14 years ago, structures of various CrtZ peptides have been elucidated. Among the CrtZ proteins which have been confirmed to have the same catalytic function, the enzyme that has the lowest homology to this *Erwinia uredovora*-derived CrtZ is a *Paracoccus zeaxanthinifaciens* (old designation: *Flavobacterium* sp. R1534)-derived CrtZ (Pasamontes, L., Hug, D., Tessier, M., Hohmann, H. P., Schierle, J., and van Loon, A. P., *Gene* 185, 35-41, 1997) with a 50% identity. Further, as described later, no CrtZ proteins have a 50% or more identity with the *Brevundimonas* sp. strain SD-212-derived peptide (CrtZ) consisting of a 161 amino acid sequence having β-ionone ring-3-hydroxylase activity as a result of search through DDBJ and GenBank databases. The CrtZ protein which has the highest identity with the *Brevundimonas* sp. strain SD-212-derived CrtZ is a CrtZ derived from *Erwinia herbicola* (recently, called *Pantoea agglomerans*) (JJBJ/GenBank accession no. M87280) with a 46% identity. Besides, according to the present invention, it was made clear that the catalytic functions of these two CrtZ proteins are identical. Taking into consideration that β-ionone ring-2-hydroxylase (CrtV) and β-ionone ring-3-hydroxylase (CrtZ) are enzymes very similar in nature, enzymes which consist of an amino acid sequence having a 50% or more identity with the peptide of (a) above and have β-ionone ring-2-hydroxylase activity (identical catalytic function) will surely be found in the future in microorganisms producing carotenoids in which position 2 of the β-ionone ring is hydroxylated. For example, such enzymes will be found by analyzing the genome of a bacterium producing carotenoids in which position 2 of the β-ionone ring is hydroxylated [e.g., *Erthrobacter* sp. strain PC6 (MBIC 02351)]. Further, the amino acid sequences of such enzymes which will be thus found in nature may be mutated by the method described earlier.

The specification on page 14 details that other genes, which encode proteins having the β-ionone ring-2-hydroxylase activity would have at least 50% homology to SEQ ID NO:4 based on the comparison with other carotenoid proteins and that this level of identity would be expected to be present in the enzymes encoded by genes isolated from other organisms. In addition, the claims have been amended to further define the peptide as being isolated from a naturally occurring bacterium.

As stated in MPEP §2163 "There is a strong presumption that an adequate written description of the claimed invention is present when the application is filed." This section of the MPEP also states that, "The claimed invention as a whole may not be adequately described where an invention is described solely in terms of a method of its making coupled with its function and there is no described or art-recognized correlation or relationship between the structure of the invention and its function." However, that is not the situation with the present claims and specification, wherein a detailed description is provided of the structure/function relationship of the claimed enzyme and with a detailed discussion of β-ionone ring 3-hydroxylase enzymes. Adequate support may be shown by "describing distinguishing identifying characteristics sufficient to show that the applicant was in possession of the claimed invention." MPEP §2163

Thus, the specification provides a detailed structure/function analysis of β-ionone ring-3-hydroxylase enzymes and a valid, substantiated basis for why the inventors contemplated and in were in possession of, as well as enabled, proteins having 50% homology to the enzyme of SEQ ID NO:4. In addition, the claims have been amended to be drawn to enzymes isolated from a limited spectrum of organisms (i.e. only bacterium). As such, the instant invention, as encompassed by embodiment (b), as amended, is both fully described and enabled in the specification and withdrawal of the rejection is respectfully requested.

3) Nucleotide sequences that hybridize under undefined stringent hybridization conditions (claim 2) – As noted above, claims 1 and 2 have been amended to incorporate the hybridization conditions recited on page 15 of the specification. As such, this rejection is rendered moot.

4) A microorganism comprising the gene of claim 2 (claim 3)- This issue appears to find its basis in the recitation in claim 2 of genes having nucleotide sequences that hybridize under undefined stringent hybridization conditions. As noted above, claim 2 has been amended to define the hybridization conditions.

5) A microorganism comprising the gene with other carotenoid biosynthesis genes from any source etc. (claims 4-6) – Applicants traverse the rejections inasmuch as they are applied to claims 4-6. The specification, on pages 17-19, provides an in depth discussion of other carotenoid biosynthesis genes and one skilled in the art would readily understand what is intended and encompassed by this term. As such, the invention of claims 4-6 is fully and adequately described and enabled in the specification and withdrawal of the rejections is respectfully requested.

6) Methods using the microorganisms of claims 6-8. – Applicants believe that the amendments and remarks regarding the issues raised for claims 1-5 also address any issues under 35 U.S.C.§112, 1st paragraph regarding the embodiments of the invention as claimed in claims 6-8.

Rejections under 35 U.S.C.§102(a)

Claims 1-8 have been rejected under 35 U.S.C.§102(a) as being anticipated by Nishida et al. (Appl. Environ. Microbiol. 2005, Vol. 71, 4286-4296) or Tao et al. (Gene 2006 Vo. 379, 101-108). The present application has a US filing date based on the PCT application of November 4, 2004.

The Examiner bases the rejection on the erroneous position that the PCT International application does not support SEQ ID NOS: 3 and 4 and thus, he considers the filing date of the application to be the US filing date of April 15, 2006. As noted above, Sequence Listings are not included with the publication of PCT applications and are maintained separately on the WIPO website as part of the electronic documents. Thus, the Examiner is directed to the WIPO website for the Sequence Listing that was filed as part of the PCT application. SEQ ID NOS:3 and 4 are

contained in the PCT sequence listing on the WIPO site. SEQ ID NOS: 3 and 4 are part of the original PCT filing and the US filing date of instant application is the International filing date of November 4, 2004. As such, neither Nishida et al. (App. Environ. Microbiol.) nor Tao et al. are prior art against the present application and withdrawal of the rejections is respectfully requested.

In view of the above amendment, applicant believes the pending application is in condition for allowance.

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact MaryAnne Armstrong, Ph.D., Reg. No. 40,069 at the telephone number of the undersigned below, to conduct an interview in an effort to expedite prosecution in connection with the present application.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37.C.F.R. §§1.16 or 1.17; particularly, extension of time fees.

Dated: FEB 18 2009

Respectfully submitted,

By _____

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